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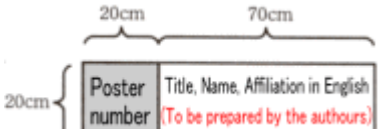

Abstract Title： Technique of reduction of the Pilon fractures with Ilizarov external fixator

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Poster Number： P119

Introduction.

Of all tibial plafond fractures, Rüedi and Allgöver type II & III, continue to present significant challenges for orthopedic surgeons engaged in trauma. (**Fig. 1)**
The treatment protocols of authors, which recommend management of pilon fractures with external fixators include: 1. Stabilization with bridge frames to regain length and resuscitate the soft tissues for 1-3 weeks. 2. Closed reduction by Ilizarov or hybrid external fixator ± open reduction of fracture ± internal fixation of fibula. 3. Removing the foot fixation in 6-12 weeks postoperatively to start ankle movement. 4. External fixation period for 12 – 16 weeks and 6 months for fractures with shaft extension.

Such delayed tactic is caused by severe soft tissues damage that does not allow early definitive treatment. Besides that, fixation of the ankle for so long period causes it contracture and fixation of lateral malleolus limits ability of external fixator to reduce any residual extraarticular deformity and can lead delayed union or malunion. At last, so long fixation in the external device is represented to us unjustified.

Knowing opportunities of Ilizarov apparatus, we decided to develop the treatment protocol according to which the definitive reduction may be carried out at the first hours after an injury, and the method of fixation permits to begin sparing loading and ankle motion in the first postoperative days. And to check up, how similar tactic influences period of union and result of treatment of these fractures.

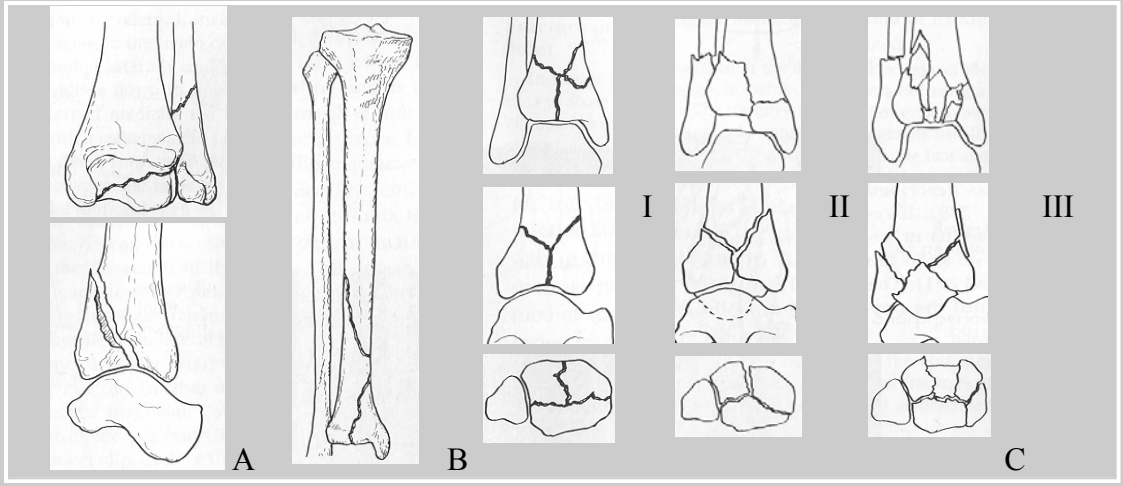

Fig. 1 Classification of Mast, Spiegel и Pappas for pilon fractures of tibia. **A**, Type I – supination-external rotation fracture with vertical loading at time of injury **. B**, Type II – spiral extension fracture**. C**, Type III –vertical compression fractures, graded by displacement and comminution according to classification of Rüedi и Allgöver. (Redrawn from Mast JW, Spiegel PG, Pappas JN: *Clin Orthop* 230:68, 1988)

Materials and Methods:

This study is a retrospective examination of 42 pilon fractures at 41 patients, aged from 24 till 71 (mean 46). From them 36 were men and 5 women. Etiology of injury in 24 cases was fall from the height, motor vehicle accident at 10 patients, fall in stairwell at 5, and 2 were shot by gun. 27 fractures were located at right ankle and 15 at left one. 9 fractures were opened and classified as Gustilo-Andersen type II-III. Extension to the tibial shaft was noticed at 15 patients. In 38 cases fibula was broken. The fractures were classified by standard X-Rays and CT according to Rüedi and Allgöver (**Fig. 1**) 24 fractures were type II and 18 type III. Associated injuries were noticed at 7 patients. 3 cases of compression fractures of the lumbar spine, 2 contralateral tibial fractures, 1 patient suffered from ipsilateral hip fracture dislocation and 1 more had distal radius fracture.

Our treatment protocol includes:

1. Early definitive reduction of the pilon fracture with Ilizarov apparatus.
2. Start Ankle motion and partial weight bearing within 48 hours of surgery.

3. Fixation period for 12 weeks.
4. Removing of Ilizarov apparatus when X-rays show signs of union and no pathological motion at the fracture site are observed.

Our configuration of Ilizarov apparatus, in which the different size of rings and their separate fixation are used, allows for free manipulation during closed reduction and helps when open reduction is needed (**Fig.2**)

Fig. 2 Frame design. The frame consists of proximal base from 2 rings and distal base framework from 2 half rings connected by 2 plates in such manner that forward one can change the angle of inclination.(**A,B**) Diameter of these rings and half rings are 180 mm. The proximal and distal base connected between themselves by 4 roads distributed in regular intervals on a back half of bases. To anterior half of proximal base, 150 mm ring for fixation of epiphyseal fragments is connected independently from connection between bases.(**C,D**) In case the fracture extends to diaphysis of the tibia, one more 160 mm. ring is placed between proximal base and "epiphyseal" ring.(**E**)

It's commonly believed that fibular plating helps reduction of the tibial fracture but in our patients, it diminished the ability to obtain a closed reduction by ligamentotaxis. The figures 3 and 4 show a worked up succession of the reduction of these fractures

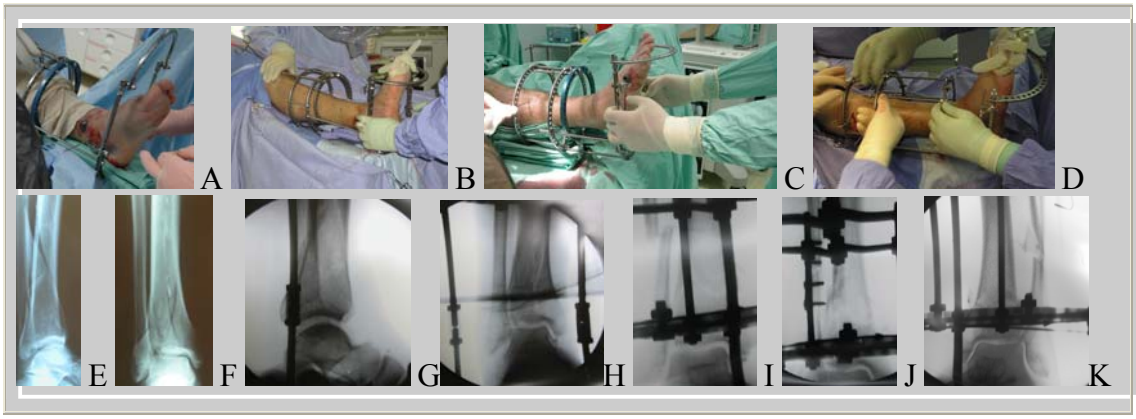

Fig. 3 Reduction technique.1 Application of distal base-**A, B**. 2 Closed reduction by manual traction-**C.** 3 Fixation of proximal base-**D**. This maneuver causes closed reduction in most of the cases-**E-G**. 4 If reduction of tibial plafond fails, trail traction of the lateral malleolus is undertaken-**I**. If fibular traction improves the plafond reduction, it may be plated-**J**. Our preference to place a wire across both bones to allow later dynamization-**K**

If fibular traction isn't helpful, an open reduction is undertaken. (**Fig. 4**)

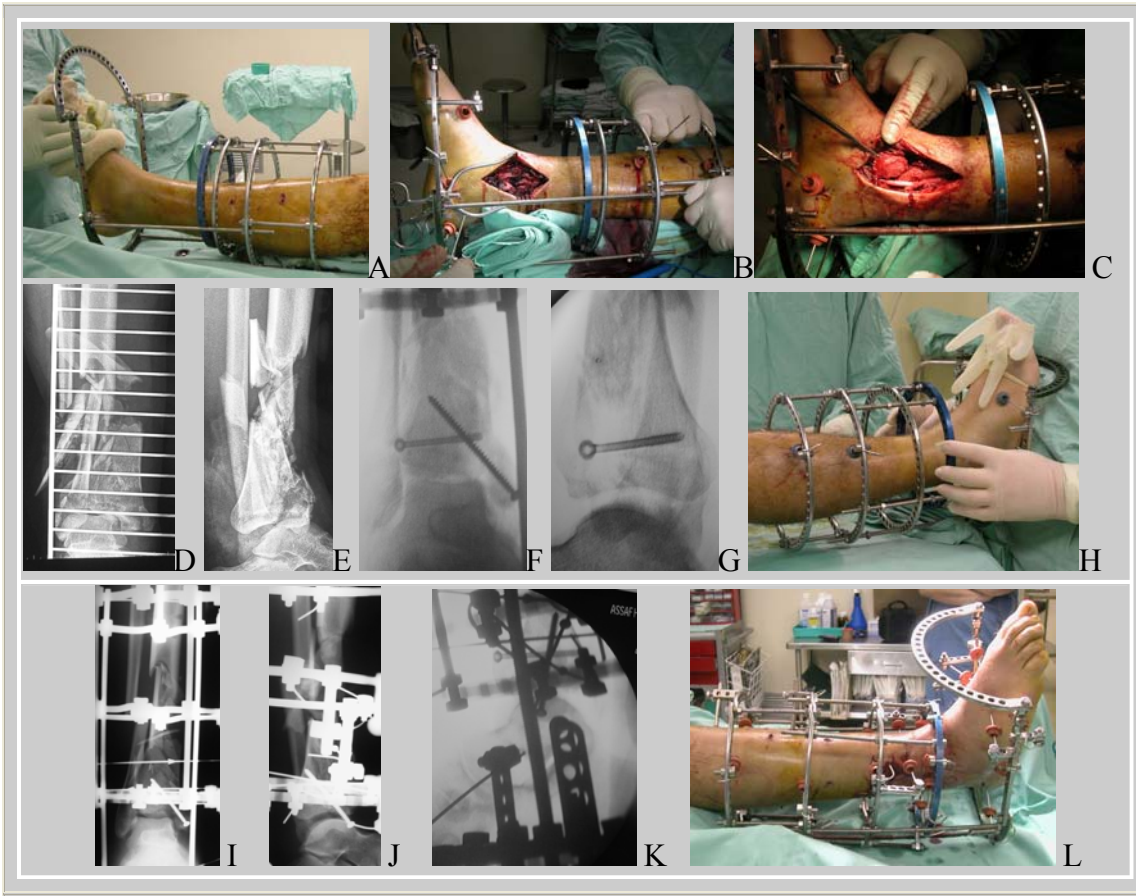

Fig. 4 Reduction technique (continue). The frame construction allows a free approach to the fracture-**B, C**. 5 After closed or opened reduction, the "epiphyseal" ring is placed above the articular line-**H** and 4 olive wires are inserted to fixate the fragments. If necessary, one or two screws augmented fixation-**F,G**. 6 Final reduction of extraarticular components is achieved by standard Ilizarov's technique-**I, J**.

Recently we also noted that we have been able to improve any extraarticular malreduction using an **Hexapod set** for the Ilizarov apparatus. (**Fig. 5**)

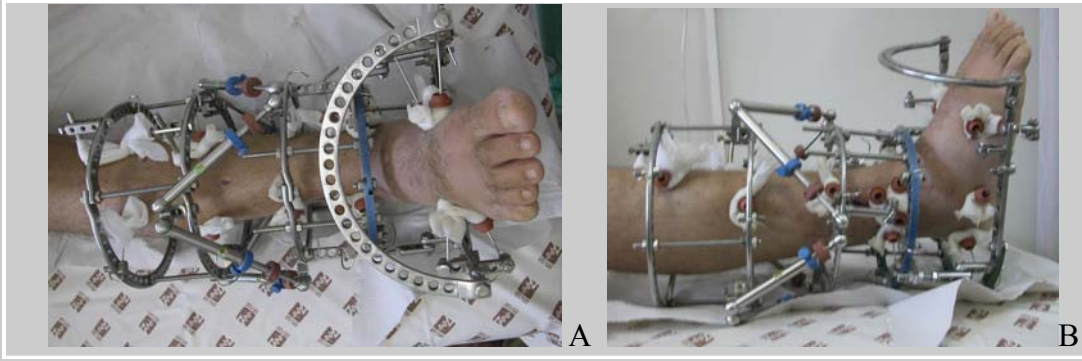

Fig.5 Hexapod set for Ilizarov apparatus helps to improve the extraarticular reduction.

Results.

16 patients had definitive reduction in the first 24 hours. 19 were operated between 2-7 days and 6 more patients were delayed up to two weeks. 6 open fractures had an initial washout and a return to the OR for definitive treatment. Delays were never related to the condition of the soft tissues.27 fractures underwent closed reduction, 15 – open. 9 patients had ORIF of the fibula. 11 underwent limited internal fixation.

Fig. 6 Adequate reductions were achieved in all fractures at surgery.

The average fixation period was 94 days. Complications included 1 case of wound ischemia, 5 patients with superficial and 1 with deep pin tract infections. With an average follow-up of 45 months, all fractures are united. 31 patients (75%) are back at work to

their previous occupation. Malunion was observed in 4 cases (9.5%). 3(7%) cases – poor results.

Fig. 7 Four years results type II (upper row) and type III (lower row) pilon fractures

Conclusions: The use of Ilizarov fixator permits for the early definitive fixation of Pilon fractures, usually without fibular plating, decreases healing time and improves final results for these difficult fractures. We have not found a need to delay surgery for soft tissue considerations.